

Att'y Ref. No.: 003-101

U.S. App. No.: 10/725,563

**REMARKS**

Favorable reconsideration, reexamination, and allowance of the present patent application are respectfully requested in view of the foregoing amendments and the following remarks.

**Rejection under 35 U.S.C. § 103(a)**

In the Office Action, beginning at page 2, Claims 1-7 and 10 were rejected under 35 U.S.C. § 103(a), as reciting subject matters that allegedly are obvious, and therefore allegedly unpatentable, over the disclosure of U.S. Patent No. 6,464,489, issued to Gutmark *et al.* ("Gutmark") in view of the disclosure of U.S. Patent Publication No. US 2001/0027638, invented by Paschereit *et al.* ("Paschereit"). Claims 8 and 9 were rejected under section 103(a) as allegedly being obvious over Gutmark and Paschereit, and further in view of the disclosure of U.S. Patent No. 5,719,791, issued to Neumeier *et al.* ("Neumeier"). Applicants respectfully request reconsideration of these rejections.

This application describes methods and systems useful for changing thermoacoustic oscillations in combustion systems. One aspect of the present invention is based on the general idea of combining the *per se* known acoustic excitation of the gas flow and the *per se* known modulated injection of the fuel with each other, in order to affect the same interference frequency of the thermoacoustic oscillations in a new and unexpectedly effective way. Trials have shown that the combination proposed by the invention has a surprisingly high suppression / damping action for the respective interference frequency, which goes considerably beyond the damping action of the known acoustic gas flow excitation by itself, beyond the damping action of the known modulated fuel injection by itself, and beyond the damping action expected for a simple combination of these two methods. The unexpected improvement in the damping action is in this case traced back to synergistic effects which surprisingly occur but have not yet been explained.

Claim 1 relates to a method of affecting thermoacoustic oscillations in a combustion system having a combination of steps including, *inter alia*, coordinating the acoustic excitation of gas flow and the modulated injection of fuel to affect the same interference frequency of the

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thermoacoustic oscillations.

Claim 7 relates to a device for affecting thermoacoustic oscillations in a combustion system having a combination of elements including, *inter alia*, at least one acoustic source configured and arranged for producing acoustic excitation of a gas flow forming in the region of a burner, the burner having at least one fuel supply device with at least one control valve for producing modulated injection of the fuel, and a control system which drives the at least one acoustic source and the at least one control valve to affect the same interference frequency of the thermoacoustic oscillations.

The prior art, including *Gutmark*, *Paschereit*, and *Neumeter*, fails to disclose, describe, or fairly suggest combinations as recited in the pending claims.

Applicant notes that the present inventors are inventors named in both *Gutmark* and *Paschereit*, and therefore have an intimate understanding of their teachings. In summary, neither *Gutmark* nor *Paschereit* discloses, describes, or suggests the combinations recited in the pending claims.

*Gutmark* discloses a method and a device each adapted for affecting thermoacoustic oscillations by means of acoustic excitations. According to the passage cited in the Office Action, column 5, lines 22 to 63, the method/device of *Gutmark* is in principle adapted for adapting the acoustic excitation to the current interference frequency of the thermoacoustic oscillations. That interference frequency can change during operation of the burner, and the acoustic excitation can be adapted to this change of the interference frequency. This application of changing the frequencies is only related to tracking the acoustic excitation to the current interference frequency. Furthermore, modulation of the equivalence ratio referred to in *Gutmark* is not the same as fuel modulation, such as that taught in this application. By way of non-limiting example, paragraph [0031] of this application describes that only a relatively small proportion of the injected quantity of fuel is modulated, *e.g.*, less than 20%, which does not significantly change the equivalent ratio. Nowhere does *Gutmark* disclose, describe, or suggest that its acoustic excitation should be combined with any other method of affecting thermoacoustic vibrations in a combustion system.

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*Paschereit*, on the other hand, discloses a method and a device each adapted for affecting thermoacoustic oscillations by means of modulated fuel injection. While *Paschereit*'s contribution to the art is an interesting one, nowhere does *Paschereit* identify that thermoacoustic oscillations can be affected by acoustically exciting the shear layer, or that its fuel modulation approach should be combined with such excitation, and therefore *Paschereit* also fails in identifying that a combination of acoustic excitation and fuel injection modulation would be anything other than alternatives addressed at thermoacoustic oscillations. As summarized by *Paschereit*:

The quantity of fuel which is converted into extensive vortices can be influenced by controlled modulation of the fuel flow of the premixing of a premix burner. According to the invention, the spraying of liquid or gaseous fuel into the premix burner is effected in a modulated manner. According to the invention, the expression modulated spraying refers to any fuel spraying varying with respect to time. According to the invention, the modulation may be effected at any frequency. The spraying is preferably effected at a frequency of between 0.3 Hz and 5 kHz, the range of 5 Hz to 200 Hz being especially preferred. In this case, the spraying is effected independently of the phase of the pressure vibrations in the combustion system

(*Paschereit*, para. [0007]).

One of ordinary skill in the art would find no motivation to combine the disclosures of *Gutmark* and *Paschereit* to arrive at the presently claimed invention. Instead, the claimed combinations could only be arrived at through an impermissible hindsight reconstruction of the claimed combinations by reference to the Applicant's own specification.

The person skilled in the art is often confronted with the problem of reducing or damping thermoacoustic oscillations. In the state of the art, the skilled person will find *Gutmark* and *Paschereit*, each disclosing a state of the art solution to that problem. The skilled person will recognize, upon a full and fair reading thereof, that the solutions of *Gutmark* and *Paschereit* are equivalent, yet alternative solutions to the problem; the skilled artisan would choose one or the other to solve his problem. The skilled artisan will not find motivation to combine their teachings.

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In *Gutmark*, at column 3, lines 22 to 31, the skilled person will find *Gutmark*'s comment that modulation of the equivalence ratio, *i.e.*, the fuel/oxidizer-ratio, is with respect to acoustic excitation an alternative way of damping thermoacoustic oscillations, but an alternative way which is ineffective with respect to the acoustic excitation taught by *Gutmark*. The Office Action's positions therefore demand the question: why should the skilled artisan combine the effective acoustic excitation of *Gutmark* with the less effective modulation of the equivalence ratio? *Gutmark* thus teaches away from a general combination of *Gutmark* and *Paschereit*, because the person of ordinary skill in the art would not expect to improve the "good" method with the "bad" method, as *Gutmark*'s disclosure characterizes them. Furthermore, modulation of the equivalence ratio, referred to in *Gutmark*, is not the same as the fuel modulation.

Additionally, *Gutmark*'s solution to the general problem involves other problems (*e.g.*, mounting and controlling of acoustic generators) when attempting to realize acoustic excitation. Realization of the fuel modulation approach according to *Paschereit* is associated with yet further problems (*e.g.*, mounting and controlling of fuel control valves). The skilled person thus is faced with, on the one hand, all the various realization problems and recognizes, on the other hand, that the solution according to *Paschereit* will be less effective than the solution according to *Gutmark* (discussed above). The skilled artisan would therefore be motivated away from any combination of *Gutmark* and *Paschereit*, because there is no economically interesting solution in combining the two alternatives.

With respect to Claim 5, neither *Gutmark* nor *Paschereit* discloses any suggestion how to perform a combination of acoustic excitation and fuel modulation. Therefore, one of ordinary skill in the art would not expect that there could be a relationship between the two alternative methods. Performing the acoustic excitation upstream of the fuel modulation can lead to a significant improvement of the damping effect, yet the skilled person would not find any indication in *Gutmark* and *Paschereit* for such positive effect.

*Neumeier* adds nothing to the defective *prima facie* case offered in the Office Action, as *Neumeier* also fails to disclose, describe, or suggest combining acoustic and fuel modulation approaches to dealing with thermoacoustic oscillations in combustion systems.

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For at least the foregoing reasons, Applicants respectfully submit that the subject matters of Claims 1-10, each taken as a whole, would not have been obvious to one of ordinary skill in the art at the time of Applicant's invention, are therefore not unpatentable under 35 U.S.C. § 103(a), and therefore respectfully requests withdrawal of the rejection thereof under 35 U.S.C. § 103(a).

### **Obviousness-type Double Patenting Rejection**

In the Office Action, beginning at page 6, Claim 7 was provisionally rejected under the judicially-created doctrine of obviousness-type double patenting as reciting subject matter that is allegedly not separately patentable over the subject matter recited in Claim 7 of co-pending U.S. Patent Application No. 10/725,564 (" '564 application"). Applicants respectfully request reconsideration of this rejection.

M.P.E.P. § 804 *et seq.* set out the minimum requirements for a double-patenting rejection in an Office Action. A brief review of this Office Action's rejection reveals that the rejection is so deficient that Applicant has not been fully apprised of the grounds of the rejection, and therefore have been denied the opportunity fully respond. Subsection II(B)(i) of M.P.E.P. § 804 instructs:

Since the analysis employed in an obviousness-type double patenting determination parallels the guidelines for a 35 U.S.C. 103(a) rejection, the factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are employed when making an obvious-type double patenting analysis. These factual inquiries are summarized as follows:

- (A) Determine the scope and content of a patent claim relative to a claim in the application at issue;
- (B) Determine the differences between the scope and content of the patent claim as determined in (A) and the claim in the application at issue;
- (C) Determine the level of ordinary skill in the pertinent art; and
- (D) Evaluate any objective indicia of nonobviousness.

The conclusion of obviousness-type double patenting is made in light of these factual determinations.

Any obviousness-type double patenting rejection should make clear:

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- (A) The differences between the inventions defined by the conflicting claims - a claim in the patent compared to a claim in the application; and
- (B) The reasons why a person of ordinary skill in the art would conclude that the invention defined in the claim at issue would have been an obvious variation of the invention defined in a claim in the patent.

The entirety of the explanation offered in the Office Action, apart from the boilerplate in the form paragraph appropriate for such rejections, reads: "the structure recited in each of these claims are [sic] substantially identical. That the control systems function to affect different frequencies does not render the device claims distinct."

The rejection is devoid of any explanation why Claim 7 is not separately patentable from Claim 7 of the '564 application, including what are exactly the differences in their respective subject matters. By these failings, the Office Action has denied the evaluation of Claim 7 to which they are entitled (35 U.S.C. § 132; 37 C.F.R. § 1.104), and also have no substantive positions to rebut.

For at least the foregoing reasons, Applicants respectfully submit that the subject matter of Claim 7 is separately patentable over the subject matters of Claim 7 in the '564 patent application, and therefore respectfully requests withdrawal of the rejection thereof.

#### **New Claims**

New Claims 11 and 12 have been added, both of which depend from Claim 6 and are patentable for at least the same reasons.

#### **Conclusion**

Applicant respectfully submits that the present patent application is in condition for allowance. An early indication of the allowability of this patent application is therefore respectfully solicited.

If Mr. Cocks believes that a telephone conference with the undersigned would expedite passage of this patent application to issue, he is invited to call on the number below.

It is not believed that extensions of time are required, beyond those that may otherwise be

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provided for in accompanying documents. If, however, additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and the Commissioner is hereby authorized to charge fees necessitated by this paper, and to credit all refunds and overpayments, to our Deposit Account 50-2821.

Respectfully submitted,

By: 

Adam J. Cermak  
Registration No. 40,391

**U.S. P.T.O. Customer Number 36844**  
Cermak & Kenealy LLP  
515 E. Braddock Rd., Suite B  
Alexandria, Virginia 22314

703.778.6609 (v)  
703.652.5101 (f)

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